ABSTRACT OF THE DISCLOSURE

One aspect of the present invention relates to a biliverdin reductase fragment or variant including a biliverdin reductase fragment possessing one or more activities of full length biliverdin reductase, or a biliverdin reductase variant comprising one or more amino acid substitutions affecting one or more activities of full length biliverdin reductase. Expression vectors and host cells containing a heterologous DNA molecule encoding the biliverdin reductase fragment or variant are also disclosed. Isolated antibodies or binding portions thereof raised against the biliverdin reductase fragment or variant are also described. Other aspect of the present invention relate to methods of regulating protein kinase activity, regulating cell differentiation, growth, or signaling, treating cellular dysfunction or disease, and treating cells following stroke or an ischemic event, each of which involves the use of biliverding reductase or a fragment or variant thereof.